Syllabus for CET Entrance Exam for Non GATE candidates

M.Tech. (Engineering Physics) **CET Code-150**

Physics – 60% and Mathematics – 40%

PHYSICS

Interference: Young's double slit experiment, Fresnel's biprism, Thin films, Newton's rings, Michelson's interferometer, Fabry Perot interferometer.

Diffraction: Fresnel Diffraction: Zone plate, circular aperture, opaque circular disc, narrow slit, Fraunhofer diffraction: Single slit, double slit, diffraction grating, resolving power and dispersive power. Polarization: Types of polarization, Brewsters law, Malu's Law, Nicol prism, double refraction, quarter-wave and half-wave plates, optical activity, specific rotation.

Lasers: Introduction, coherence, population inversion, basic principle and operation of a laser, Einstein A and B coefficients, type of lasers, He-Ne laser, Ruby laser, semiconductor laser, holography-theory and applications

Fibre Optics: Types of optical fibres and their characteristics, (Attenuation and dispersion step index and graded index fibres, principle of fibre optic communication-total internal reflection, numerical aperture, fibre optical communication network (qualitative)-its advantages.

Theory of Relativity: Galenlian transformations, the postulates of the special theory of relativity, Lorentz transformations, time dilation, length contraction, velocity addition, mass energy equivalence.

Thermodynamics: The first law and other basic concepts: dimensions, units, work, heat, energy, the first law of thermodynamics, enthalpy, equilibrium, phase rule, heat capacity, PVT behavior of pure substances, ideal gas, real gas, heat effects. The second law and Entropy: statements, heat engines, Kelvin-Planck and Clausious statements and their equality, reversible and irreversible processes, Carnot cycle, thermodynamic temperature scale, entropy,ent ropy calculations, T-S diagrams, properties of pure substances, use of steam tables and Mollier diagram. Refrigeration and liquefaction: the Carnot refrigerator, the vapor–compression cycle, comparison of refrigeration cycles, liquefaction processes, heat pump. Rankine power cycle.

Quantum Mechanics: Wave particle duality, deBroglie waves, evidences for the wave nature of matter – the experiment of Davisson and Germer, electron diffraction, physical interpretation of the wave function and its properties, the wave packet, the uncertainty principle. The Schrodinger wave equation (1 – dimensional), Eigen values and Eigen functions, expectation values, simple Eigen value problems – solutions of the Schrodinger's equations for the free particle, the infinite well, the finite well, tunneling effect, simple harmonic oscillator (qualitative), zero point energy.

Quantum Statistics: The statistical distributions, Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac statistics, their comparisons, Fermions and Bosons. Applications: Molecular speed and energies in an ideal gas. The Black-body spectrum and failure of classical statistics to give the correct explanation - the application of Bose-Einstein statistics to the Black-body radiation spectrum, Fermi-Dirac distribution to free electron theory, electron specific heats, Fermi energy and average energy -its significance.

Band theory of solids: Origin of energy bands in solids, Kronig-Penny model, Brillouin zones, effective mass, Metals, semiconductors and insulators and their energy band structure. Extrinsic and intrinsic semiconductors, p-n junction diodes- its characteristics, tunnel diode, zener diode, photodiode, LED, photovoltaic cell, Hall effect in semiconductors, transistor characteristics (common base, common emitter, common collector). Digital techniques and their applications (registers, counters, comparators and similar circuits) A/D and D/A converters

Superconductivity: ZFC and FC, Meissner effect, Type I and II superconductors, the Josephson effect, flux quantization, Cooper pairs, BCS theory, properties and applications of superconductors.

X-rays: production and properties, crystalline and amorphous solids, Bragg's law, applications.

Electricity and magnetism: Electric fields, Gauss' Law, its integral and differential form, applications. Lorentz force, fields due to moving charges, the magnetic field, Ampere's law, motion of a charged particle in an electric and magnetic field, magnetic and electrostatic focussing, Hall effect, determination of e/m by cathode ray tube, positive rays, Thomson's parabolic method, Isotopes, Mass spectrographs (Aston and Bainbridge), Electron microscope, Cyclotron and Betatron.

Overview of Electro – Magnetism: Maxwell's Equations: The equation of continuity for Time – Varying fields, Inconsistency in ampere's law Maxwell's Equations, conditions at a Boundary Surface, Introduction to EM wave.

Nuclear Physics: Introduction of nucleus, Nucleus radius and density, Nuclear forces, Nuclear reactions, Cross section, Q-value and threshold energy of nuclear reactions, Basic Idea for Nuclear Reactor, Breeder reactor, The Geiger-Mullar (G.M.) Counter, Introduction of Accelerators and its Applications. Numerical techniques: Interpolations, differentiation, integration; Nonlinear equations, the bisection methods, Newton's method, root finding; Differential equations, Euler's method, the Runge-Kutta method; Matrices-inverting, finding eigenvalues and eigenfunctions.

MATHEMATICS

Linear Algebra : Linear Independence and dependence of vectors, Systems of linear equations – consistency and inconsistency, rank of a matrix, Gauss elimination method, , Eigen values and Eigen vectors.

Differential Calculus : Successive differentiation, Leibnitz's theorem, Lagrange's Theorem, Cauchy Mean value theorems, Taylor's theorem, Asymptotes, Curvature. Partial derivatives, Method of Lagrange's multipliers Jacobeans of coordinates transformations.

Integral Calculus : Reduction Formulae of trigonometric functions, Properties of definite Integral, Applications to length, area, volume, surface of revolution. Double and Triple integrals.

Differential Equations : Method of separation of variables, homogeneous, linear equations, exactness and integrating factors, linear equations of higher order with constant coefficients, Operator method to find particular integral.

Vector Analysis : Scalar and vector fields, Directional Derivative, Gradient of scalar field, divergence and curl of a vector field. Green's theorem, Divergence theorem and Stoke's theorem.

Probability: Definition of Sample Space, Event, Event Space, Conditional Probability, Additive and Multiplicative law of Probability, Baye's Law theorem, Application based on these results.